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Editorial

There has been for quite a long time a controversy over the utility and place of fundamental research in science in institutions of applied research. This is no where, so vehemently argued upon as in the Agricultural Research Institutes of India. The Egerton Committee which reviewed the work of the National Laboratories of India has made several comprehensive recommendations. One of its recommendations deals with the fundamental research. It points out that fundamental research (researches conducted to gain knowledge) has led almost always to new applications and that it is wise not to tie the research programmes of an institute too completely to purely practical problems but to encourage fundamental work being done along with researches of more immediate application. Biological sciences can never be reduced to the level of mathematical formulae or mechanical accuracy as in the mathematical and other sciences. Too much stress on the practical side may stultify the view as in Russia where it has ended in mere campaign against Mendelian and Neo-mendelian theories, though their basic principles are being applied daily in hybridisation and selection. It is difficult at anytime to draw a line where any research remains fundamental and where it becomes practical. The study of algae is admittedly of no use in practical agriculture of crop plants. Yet, today the role played by some of the algae found in the paddy fields has become a problem of applied science. Similarly the application of a number of ready made manures, weedicides, fungicides and pesticides has become easy and it appears as though, that no more study on them is necessary, yet it is here that more fundamental research is urgent. Though agriculture is practiced successfully by an ordinary farmer, agricultural science is one of the most complex problems known to man. It is in these biological sciences like agriculture and medicine that utmost team work is necessary. A lone worker is not of much use. All agricultural workers should align themselves to a set programme of team

work in order to achieve sound results. In this connection the Egerton committee has suggested that the Council of Scientific and Industrial Research should be the co-ordinator. The committee has also stressed the advantages of free communication and exchange of views between workers, the encouragement of training of post graduate students, the undertaking of lectures at post graduate level by research workers at university centres and the importance of the university teachers and workers visiting the research centres so that right sort of workers might be turned out of these teaching centres and not the least the freedom for the research worker, time and financial help for the research institutes. In this connection it has called upon private firms to organise research centres not only to serve their own needs but also that of the nation at large through promoting fundamental research. The knowledge of a biological system whether it be plant, animal or human being is of vital necessity before any lasting research work can be done on them and therefore it is of great importance that fundamental research should be given due encouragement.

Cultivation Practices in Sandy Soils of Bapatla

by

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Bapatla, in Guntur district, is a small town on the East Coast, situated on the North-East line of the Southern Railway, five miles away from the sea. A strip of land about six miles in width along the coast is sandy in nature. The soils under continuous cultivation, adjoining the villages, have accumulated some organic matter. The water table is high, being four to six feet deep and in the rainy season it is very near the surface at two feet depth. In summer it may go down to eight to ten feet. The water is slightly brackish, but not injurious to crops. The soils are not fertile, but under irrigation respond well to manuring, organic and inorganic. The high water table is taken advantage of for the cultivation of crops in a large-scale sand culture. Temporary wells called "doruvus" are dug and water is taken from the "doruvus" with earthen pots for splash watering. (Vide plate 1). Cattle manure is the chief bulky manure in use, but it is always inadequate. Penning cattle and sheep is supplementary. These manures are applied only for paying crops in small areas to increase the yield. Sulphate of ammonia is used liberally for all crops, followed by profuse waterings. This is a tract where this fertiliser has been in extensive use since a long time and is locally termed as "super"

The salient features of the cultivation are regular splash watering throughout the growth period, with periodical top dressings of sulphate of ammonia, with or without basal dressings of cattle manure or sheep-penning. The cultivated area is confined to small holdings owned or leased, varying from 25 to 50 cents and intensively cultivated. The whole family works and earns a good wage throughout the years. The crops grown and the rotations followed are:

May to July—Paddy nurseries.
August to November—Virginia tobacco nurseries.
December to March—Ragi. or
December to June—Brinjal and Chilli—once in three years.

A small plot of few cents is set apart for jasmine which is retained for about ten years. Ragi and sometimes, vegetables like greens and cucurbits are also grown. Even the owner cultivators are sometimes forced to take out some land on lease. The lease ranges from eight annas to one rupee per cent.

Large holdings are few as it does not pay to hire labour and cultivate. It is also difficult to manure adequately. Hence, cultivation of rainfed crops viz. groundnut, cowpea, and horse-gram, is common. Their success depends upon the rainfall which is normally sufficient and fairly well-distributed as shown below, (Average of ten year period from 1943 to 1952):

South-West monsoon period—June to September—20·26" on 50 days.
North-East monsoon period—October to January—11·63" on 16 days.
Dry weather period—February to May—3·66" on 8 days.
Total rainfall for the year—35·55 on 74 days.

Under conditions of extensive cultivation in large holdings, the following rotation is common: June—July to September—October—groundnut or cowpea; October—November to January—February—Horsegram or cowpea. Late season cropping is confined to only such lands where there is some residual fertility left i. e. after the removal of casuarina, paddy and tobacco nurseries, or where sufficient manure was applied in previous years. Otherwise, it does not pay to grow two crops in a year. Casuarina plantations and raising of virginia tobacco seedbeds are taken up even with hired labour. Casuarina comes in such lands periodically, planted in July—August and is retained for seven to ten years.

Except in rainfed crops, in all other cases, the cultivation is rather peculiar, though simple. The cultivation details of the various crops are described hereunder.

1. **Paddy Nurseries:** The wetland area of Bapatla and the adjoining villages is situated towards the west, beyond the sandy soil belt. They are irrigable under the Krishna delta system. This area is at the tail-end of the irrigation channels. As such, water is usually received late in the season. There is no other source of water in the wetlands to raise the seed beds in advance. If nurseries are raised after the receipt of water in the irrigation canals, planting will be delayed. The wetland ryots are therefore compelled to go in for the seedlings that are grown in sandy soils. Nurseries are raised with the popular varieties and often fetch remunerative returns. The areas are small, with about five to ten cents in each holding.

The plot is ploughed twice with a country plough. No basal dressing is given. In rare cases sheep are penned at 2,000 sheep per acre. Seed is sown broadcast at 12 to 15 pounds per cent. The heavy seed rate is to minimise the area, to facilitate manuring and splash watering. The seed is covered by ploughing twice and levelled with a brush harrow. Sand is sprinkled in a thin layer to cover the exposed seed, and splash-watered twice a day. On the third day after sowing, sulphate of ammonia at two pounds per cent or powdered groundnut cake at six pounds per cent—usually

the former—is applied and the plot is lightly ploughed twice. This is a peculiar practice called "*muragadammu*" in this locality. It is intended to incorporate the topdressing applied and to bring up the deep-seated ungerminated seed to the surface. Then plots are formed four feet wide with pathways in between for watering. The beds are levelled and regularly splash-watered twice a day in the mornings and evenings. A fortnight later, another topdressing is given at half the first dose, with sulphate of ammonia. If found necessary, a light third dressing is given a fortnight after the second dressing to push up the seedlings. The seedlings will be ready for planting in 40 days but can be retained up to two months. Sheep-penned plots receive very light dressings of the fertiliser. Seedlings from two to two and a half cents would be sufficient to transplant an acre and usually fetch Rs. 15/-. Sowings commence from the last week of May and continue till the end of June, and the seedlings are pulled out in July—August.

2. **Virginia Tobacco Nurseries:** The sowing season commences from August and continues up to October to lift the seedlings from October till December. The nurseries are raised, on a large scale, even with hired labour. Ryots from the adjoining places come over here and raise the seedbeds on leased lands. The lease amount varies from Rs. 60/- to Rs. 100/- per acre. Seedlings grown in sandy soils are always preferred. They do not develop the tap root and the root system is in tufts, fibrous, and shallow. They establish very quickly and thrive better when transplanted. There is always a great demand for the seedlings from the black soil tracts of Guntur and Krishna districts, where virginia tobacco is extensively cultivated. It has been paying well to grow them.

The land is ploughed twice followed by a digging with spade. Then a third ploughing is given. Beds are formed four feet wide with pathways in between. Tobacco midribs are added as manure at 5,000 pounds (20 bales) per acre and over this, cattle manure is applied at five tons per acre. The beds are dug up to incorporate the manures, and levelled. Seed is sown at one tola per cent (2½ lb. per acre), mixed with sand and the beds are compacted by trampling. The beds are again covered over with 2,500 pounds (10 bales) of tobacco midribs and 3,000 pounds of dried casuarina leaf gathered from the plantations, to serve as a mulch. The beds are lightly watered with rose cans thrice a day (if there are no rains). For watering, eight men are required, with eight "doruvus" per acre. After three weeks, the surface casuarina mulch and tobacco midribs are removed during weeding, and a top dressing of sulphate of ammonia is given at 10 lb. per acre. A second dose is given at 20 lb. per acre a fortnight after the first and a third at 40 lb. per acre a fortnight after the second. Sometimes even four top dressings

are given, reducing the interval between the successive dressings. The beds are weeded twice. Seedlings will be ready in six to eight weeks and 6000 seedlings are required to plant an acre. They can be obtained from one to one and a half cents, fetching an average return of Rs. 25/- to Rs. 30/-.

3. **Ragi**: This is a staple food crop of the working classes. The main season is December—January to March—April. The seed-beds are dug twice with spade and cattle manure applied at 10 baskets per cent (about 300 lb.), and incorporated by spading. Seed is sown at two to three pounds per cent, raked up, levelled and watered once a day. A week after sowing, half a pound per cent of sulphate of ammonia is applied and repeated a week later. The top-dressing is followed by light watering twice a day for four days. The seedlings will be ready for planting in three weeks. Seedlings older than one month are considered inferior and are usually rejected. The main field is ploughed twice, manured with cattle manure at five to ten tons per acre or sheep-penned at 1,000 to 2,000 sheep per acre covered by ploughing and levelled. In dry sand, the seedlings are planted four inches apart and immediately splash watered, and continued once a day in the morning. (vide. plate. 2). But now and then watering is stopped for a day. A week after planting, sulphate of ammonia is applied at two pounds per cent followed by watering twice a day for four days. A second top-dressing is given at half the first dose at the time of flowering. Third dressing is rare and is given only if the crop is lagging behind. The crop matures in two months after planting. Four days prior to harvest, watering is stopped. During this period, the crop turns yellow and the earheads get hardened. The earheads are harvested all at one time. They are heaped for three days, dried, threshed and cleaned. The yields vary from 1,200 to 3,000 lb. per acre. The straw is fed to cattle either green or dry. The crop grows to a height of two feet (vide. plate. 3.), but the plants do not tiller. The cultivation just pays them their wages in kind.

4. **Groundnut**: Groundnut is cultivated in large holdings in the usual manner under rainfed conditions. The crop generally succeeds a casuarina plantation. Due to the accumulation of shed leaves, the crop comes up well without any manuring. The land is ploughed twice and is sometimes manured at about five tons per acre with cattle manure or lightly penned. The usual variety grown is the bunch variety. Kernels are dibbled in plough furrows in June—July with the commencement of regular showers. Seed

Plate 1

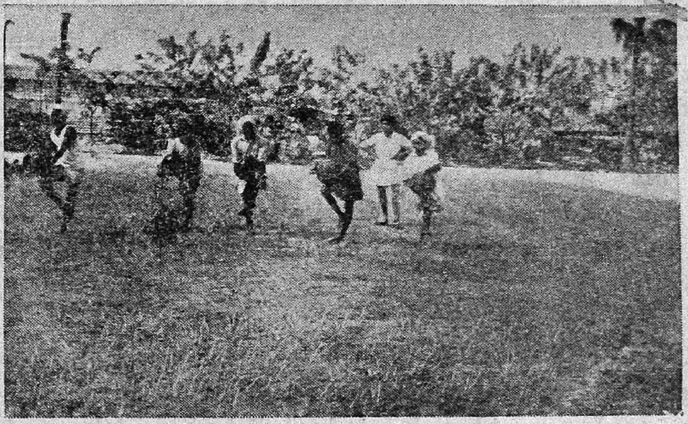

Plate 2

Plate 3

rate is 80 to 100 lb. per acre. One weeding is given in August when the crop is one month old, if necessary. The crop matures in September—October and the yield ranges from 1,000 to 2,000 lb. per acre.

5. **Cowpea** The cultivation is in the main season from June—July, but under favourable conditions it is also grown from October—November. The land is ploughed twice, either lightly manured at five tons cattle manure per acre or not manured at all. Seed is sown at 30 lb. per acre. Main season crops are harvested in November and the late season crops in February. The average yield is 400 to 600 lb. per acre.

6. **Horsegram:** This crop succeeds groundnut, cowpea, tobacco seedbeds, or casuarina, i. e. where there is some fertility to give a successful crop. The sowings take place from October to December. After two ploughings, 30 lb. seed is sown broadcast, covered and levelled. No other operation is done. The crop is harvested from January to March. The yield is 400 to 600 lb. per acre. Lands are leased out for groundnut, cowpea, and horsegram on a half and half share system, the owner supplying the seedmaterial. If manured, it is also done by the owner and in such a case the owner gets two-thirds and the tenant one-third.

7. **Green Chilli:** This is an important crop grown in all small holdings of five to ten cents area under intensive cultivation from January to June. The land is dug twice with spades and well manured with about half a ton of cattle manure per cent, and incorporated by digging. Four to six weeks-old seedlings are planted one foot apart. Splash-watering is given regularly once a day, but in midsummer watering is done twice a day. After planting, sulphate of ammonia is applied every fortnight at one pound per cent. For four days after the top dressing light watering is given twice a day in such a manner that the manure is not leached out into deeper layers but retained in the root zone. Every top-dressing of the fertiliser is followed by light sprinkling of sand taken from the sides of the "doruvus" at about 100 lb. per cent each time. This is another peculiar practice. Where cattle manure is available, powdered manure or powdered groundnut cake are also applied as top-dressings in between the fertiliser doses. A month after planting, pig dung is applied as top dressing at about 50 lb. per

cent, at the base of individual plants. Picking commences one month after planting. Picking green chillies is said to stimulate flowering and fruiting. On an average, three pickings are taken a month. The crop remains for four to five months after planting. From 12 to 15 pickings at an average of one maund per picking, 12 to 15 maunds could be easily expected, fetching at an average price of Rs. 2/- per maund, Rs. 24/- to Rs. 30/- per cent. In summer, there is a regular export of green chillies to the neighbouring places by rail and sometimes the price shoots up to Rs. 4/- to Rs. 5/- a maund.

8. **Brinjal:** The cultivation details are the same as for green chilli in all respects except that a wider spacing of 18″ is given. Picking commences two months after planting and the main pickings are taken for four months from March to June. Normally 12 pickings each of one maund at Rs. 3/- per maund fetch Rs. 36/- a cent. There were instances where one maund was sold at Rs. 8/-.

9. **Jasmine:** It is a common practice in every small holding to set apart about two to five cents for jasmine. The plants are retained in the same plot for about ten years. Layers are taken from old plants. They are planted four feet apart (either way) in August – September, in shallow pits even without any manuring and watered once a day in the absence of rain, till they get established. Thereafter no care is bestowed till next February; when the leaf is stripped off, one basketful (about 50 lb.) of cattle manure is applied in the basins, dug around, and regularly watered. In three weeks the plants begin to flower and picking commences from early March. Watering is continued right through, manuring with one basket of cattle manure per plant once in three to four weeks. Application of sulphate of ammonia is not favoured, though there are instances where it is also applied. It is believed that the application of the fertiliser shortens the life of the plants. During the main picking season of March to June, 12 pickings could be obtained. Each picking gives 4 pounds of flowers per cent, costing Rs. 1/- to 1—8—0, and for the season about Rs. 15/- to 20/- may be got from one cent.

10. **Casuarina:** Casuarina cultivation is taken up on an extensive scale, since one decade and has been paying well, due to remunerative prices. The plantations are largely confined to the lands away from the villages and nearer to the coast. Seed is collected from mature fruits. Nurseries are sown in March-April at

2½ lb. seed rate per cent. The beds are watered once a day. No manure is applied. Seedlings will be ready for planting in July-August, with 1½ feet growth and are sold at Rs. 3/- to Rs. 5/- per 1000. The main planting season is July August. No manuring is adopted. Shallow scoops are made with spade. In the center of the scoop a hole is made with a crow bar and one or two seedlings are planted in each hole and pressed well. Spacing is 4½ feet both ways and 4000 seedlings are required to plant an acre. In the absence of rain, watering is given till they establish themselves. Gaps are periodically filled during the rainy season. The plantation receives watering again for two months in the first summer, thereafter no other care is taken, except engaging a watch collectively, which may come to a rupee per acre per year. The plantations are cut from the 7th to 9th year. About 3000 trees remain per acre, yielding 25 to 40 tons. In recent years, due to high prices, there is a tendency to cut even in 5 to 6 years. In such cases only 15 to 20 tons are obtained. The average price per ton is Rs. 30/- and goes up to even Rs. 60/- during January-February, the tobacco flue-curing season. Usually Rs. 100/- per acre per year is the net return.

11. **Cashewnut**: The cultivation of cashewnut is rather indifferent and confined to lands far away from the villages. In the month of July small pits are made 30 feet apart, and four to six months old seedlings are planted. In the absence of rain the plants are watered till they strike root. The plantations are not usually manured. Sometimes, the seeds are sown in the pits and covered with thorny twigs to protect the germinating nut from bird damage. The plants receive watering again during the first summer. No other operation is given. Watch is engaged during the fruiting season till the garden is sold outright for the usufruct. Fifty plants go to an acre. Inter-cropping with groundnut, cowpea, and horse-gram during the first three to five years is sometimes adopted with advantage. Bearing starts fom the fifth year, but full bearing commences only from the tenth year. During the full bearing stage about 40 lb. of nuts are gathered from a tree costing about four annas a pound. The yield is half of this from the fifth to the tenth year. Cashewnut appears to be remarkably suited to poor sandy soils, and thrives well even under neglected conditions.

12. **Other miscellaneous crops of minor importance**: (1) Amaranthus is grown in small beds throughout the year. (2) "Gogu" is

sown along the borders in rows. The leaf is used as a salad and the plants are finally pulled out for fibre. (3) Cucurbits are raised in both the seasons. In summer, ribbed gourd, bitter gourd, snake gourd, and cucumber are grown.

(4) "Davanam" (*Artemisia vulgaris*): Small nursery beds are sown with seed at one tola per square yard, mulched with straw, and lightly watered with rose can. The mulch is removed after germination and initial growth, after a fortnight. Month-old seedlings with four to five inches growth are planted four inches apart in well prepared and manured beds and watered regularly. Cattle manure is applied as top dressing every fortnight. Sulphate of ammonia is also applied now and then followed by sprinkling of sand and profuse watering. Picking starts a month after planting and continued every ten to fifteen days. The main season is December to May. From 12 pickings of one maund each per cent valued at about Rs. 60/- (at Rs. 5/- a maund) is realised. The price goes up to Rs. 7/- or Rs. 8/- in some years. (5) "Maruvam" (*Origanum marjorana*): The cultivation is identical to that of "davanam"; but no nurseries need be raised as the propagation is by cuttings which are planted six inches apart.

Conclusion: Similar soil and cropping conditions prevail in many places along the entire East Coast bordering the sea. In view of the high water table, the future line of improvement should be directed towards the reduction in the cost of watering by some means or other. Fixing cheap designs of filter points to suit the water table in conjunction with sprinkler irrigation outfit preferably with portable arrangement and worked by a small pumpset or electric motor would answer the need. Even if such units are beyond the means of small ryots, they may prove useful for raising tobacco seed beds. Well-to-do ryots may be able to bring more land under intensive cultivation or lease out lands to tenants with the equipment at enhanced rates.

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A Fruit Rot of Chillies *(Capsicum annuum L.)* caused by *Alternaria solani* (Ell. & Mart) Jones & Grout

by

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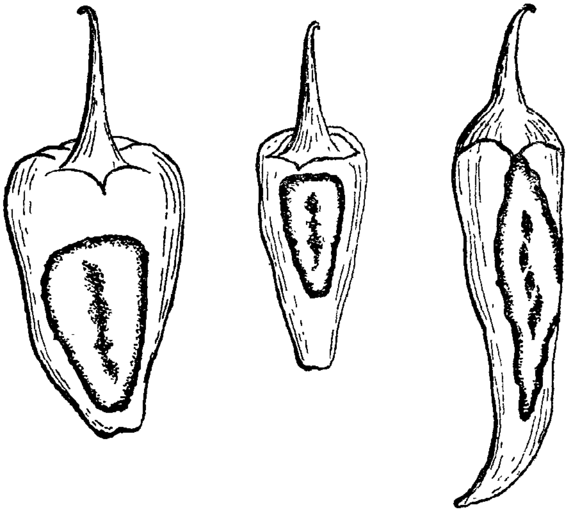
Introduction: Fruit rot of chillies is a disease of economic importance prevalent in many parts of the world. The causal organism differs in different places and more than one fungus has been found to be responsible for this disease. *Glomerella cingulata* (Stonem.) Spauld. & v. Schrenk *(Colletotrichum piperatum* Ell. & Ev.) has been recorded from India (Dastur 1920), America (Halsted 1890) and elsewhere causing anthracnose (fruit rot) of *Capsicum*. *Colletotrichnm capsici* Syd., was first observed in South India, infecting fruits and young twigs of chillies (Mc Rae 1914). Dastur (1921) has described this disease in detail from North India. More than one species of *Alternaria* have been reported to be responsible for the fruit rot of chillies. *A. solani* (Ell. & Mart.) Jones & Grout has been recorded from Georgia by Higgins (1925). Wallace (1929) reported a fruit rot of chillies caused by *A. tenuis* Nees., in Tanganiyka. In Spain, Unamuno (1934) found *A. tenuis f. genuina* Una., to be associated with the rotting of chilli fruits. Bremer (1945(from Turkey stated that *A. longipes* (Ell. & Eve.) Tisd. & Wadk. was the causal agent for the rotting of chilli fruits in that country. *A. capsici-annui* Savul. and Sandu has been known to be responsible for this disease in Rumania (Savulescu & Hulea 1948). Dutt (1938) reported a fruit rot of chillies from Delhi, caused by *Alternaria* but the species was not determined.

In recent years, specimens of chilli fruits affected by *Alternaria* have been collected from Mathurai and Guntur districts. This disease occurred along with the fruit rot caused by *Colletotrichum capsici* Syd., and often passed off for infection by the latter fungus. The present paper is concerned with the isolation of the fungus and study of its pathogenicity, cultural characters and host range.

Material and Methods: The pathogen was brought into culture by the single spore isolation method and its growth on a number of agar media was studied. Inoculation experiments were conducted on fruits kept in moist chambers after surface sterilisation or on those growing on the plants themselves. Leaf and twig inoculations were carried out on young plants grown specially for the purpose. For the study of the rate of growth of the fungus, equal quantities of the inoculum were used and the media were adjusted to the same reaction. The colour nomenclature described in Ridgeway's "Colour Standards" has been adopted for describing the colour of the growths on the various media.

Symptoms of the disease: Fruits which were nearing maturity were ordinarily infected. Brown lesions surrounded by a yellow

halo developed on one side of the fruit. These enlarged and resulted in the formation of irregular sunken patches with a dark brown margin and light grey centre. The latter was overgrown by olive-brown fungal growth. The fruit lost its red colour and usually dropped down. Sometimes the entire fruit was involved in the rot.



Chilli fruits showing the symptoms of the disease

The incidence of fruit rot was very high if the humidity increased or it rained during the maturing stages of the fruits, resulting in a heavy loss of fruits. This disease can be distinguished from the fruit rots caused by *Colletotrichum capsici* Syd. or *Glomerella cingulata* by the absence of the characteristic acervuli on the diseased spots.

The fungus and its cultural characteristics: To start with, the mycelium is internal and after the collapse of the tissues, brown mycelial growths develop on the surface of the lesions. Numerous light brown, septate, unbranched conidiophores are found in clusters of 3 to 6 from the external mycelium, measuring 105 x 4μ (90–144 x 3–6·5). Obclavate, muriform conidia, olive brown in colour are formed, often in chains on the conidiophores and measure 65 x 18μ (49 to 112 x 12 to 25) on the average. The number of cells in the spores varies; 8 to 12 transverse septa and 3 to 6 longitudinal septa are found in each spore. The beak is usually small.

Profuse aerial growth usually develops on agar media. In the initial stages, the hyphae are hyaline forming a whitish aerial mycelium. Later, the growth becomes dark grey and forms an olivaceous black mat on the surface of the agar. The dark

discolouration extends into the medium also. Profuse sporulation was evident on most of the media. The cultural characters of this fungus and the average rate of daily growth on various media adjusted to pH 5·7 are given below:

TABLE I

Cultural characters on various media

Name of medium	Average rate of daily growth in m.m.	Cultural characters after 7 days
1. Oat agar	6·6	Good growth, aerial mycelium dark grey, olivaceous black on agar surface, reverse black, spores plenty in 48 hours.
2. French bean agar	7·5	Fluffy white aerial mycelium, good and uniform growth; the older mycelium tends to be mineral grey, reverse purple black, spores numerous within 48 hours.
3. Maize agar	7·0	Aerial mycelium light mineral grey over a dark dull yellow substratum, reverse sooty black, growth was good and uniform. Spores abundant within 48 hours.
4. Carrot agar	7·0	Loose aerial mycelium, pearl to storm grey, adpressed over a dusky olive-green growth on the surface of the agar medium. Zonations noticed on the reverse; reverse black, spores plenty in 48 hours.
5. Czapek Dox's agar	7·0	Aerial mycelium white to ash-grey in the centre, on olivaceous black background reverse french grey to light violet grey; no spores in 48 hours.

French bean agar appears to be the most satisfactory medium for the growth of this fungus.

Pathogenecity: Repeated inoculations were carried out on surface-sterilised fruits of chillies, brinjal and tomato kept in sterilised moist chambers and those growing on plants. Leaves and twigs of *Capsicum annuum, Solanum melongena, Lycopersicum esculentum, Datura stramonium, Nicotiana tabacum, Gossypium hirsutum* and *Cyamopsis tetragonaloba* were inoculated. The following table shows the results of inoculation.

TABLE II.

Results of Inoculation with the Fungus.

Name of plant	Part inoculated	Method of inoculation	Number inoculated	Number infected
1. *Capsicum annuum*	Leaves and twigs	Wounded	12 plants	Nil
	Leaves and twigs	Unwounded	12 plants	Nil
	Fruits	Wounded	24 fruits	15 fruits rotted within 7 days after inoculation
	Fruits	Unwounded	24 fruits	14 fruits rotted within 7 days after inoculation
2. *Solanum melongena*	Leaves and twigs	Wounded	6 plants	No infection
	Leaves and twigs	Unwounded	6 plants	No infection
	Fruits	Unwounded	12 fruits	10 fruits rotted within 7 days after inoculation
3. *Lycopersicum esculentum*	Leaves and twigs	Wounded	6 plants	No infection
	Leaves and twigs	Unwounded	6 plants	No infection
	Fruits	Wounded	6 fruits	4 fruits rotted within 7 days after inoculation
	Fruits	Unwounded	6 fruits	3 fruits rotted within 7 days after inoculation
4. *Datura stramonium*	Leaves and twigs	Wounded	6 plants	No infection
		Unwounded	6 plants	No infection
5. *Nicotiana tabacum*	Leaves and twigs	Wounded	6 plants	No infection
		Unwounded	6 plants	No infection
6. *Gossypium hirsutum*	Leaves and twigs	Wounded	6 plants	No infection
		Unwounded	6 plants	No infection
7. *Cyamopsis tetragonaloba*	Leaves and twigs	Wounded	6 plants	No infection
		Unwounded	6 plants	No infection

Suitable controls were kept in all cases and they remained healthy throughout the experiment.

The results of inoculation show that the fungus is pathogenic on the fruits of chillies, brinjal and tomato. There was no infection on the leaves of any of the plants tried. The symptoms of infection on the fruits were evident on the fourth day after inoculation. The infected fruits were completely rotten in the course of one week. In all cases the fungus was reisolated from the infected fruits.

Identity of the Fungus: Four species of *Alternaria* have been recorded on *Capsicum.* A comparative statement of the chief distinguishing characters of the different species of *Alternaria* recorded on chillies is given below:

TABLE III

Character of the species of *Alternaria* recorded on Chillies

Name of species	Conidial measurements in μ	Chief distinguishing characters	Authority
1. *A. longipes*	30 — 50 × 10 — 13	Infects only wounded chilli fruits and incapable of infecting tobacco or chilli leaves	Bremer 1945
2. *A. solani*	145 — 370 × 16 — 18	Infects the leaves of almost all solanaceous plants	Higgins 1925
3. *A. tenuis*	30 — 36 × 14 — 15		Wallace 1929
4. *A. tenuis f. genuina*	27·5 — 62·5 × 12 — 17·5	Found on leaves, peduncles floral buds and unripe fruits of chillies	Unamuno 1934
5. *A. capsici-annui*	33 — 82 × 7 — 21	Capable of infecting tobacco and chilli leaves also	Savulescu and Hulea 1948
6. *Alternaria* sp.	14 — 50 × 7 — 19	Capable of infecting all portions of chillie plant	Dutt 1938
7. The present isolate under study	49 — 112 × 12 — 25	Capable of infecting only the fruits of chillies, tomatoes and brinjal	

From the above characters of the various species it can be inferred that the isolate under study does not completely agree with any of the others. But, it exhibits affinities to *A. longipes* in being incapable of infecting tobacco and chilli leaves but infecting the fruits. But the spores are much bigger than those of *A. longipes.* In this character, it comes near *A. solani*, but differs from the latter in its failure to infect the leaves of any of the solanaceous

plants tried. It is considered that it is more likely that the present isolate is a strain of *A. solani* which infects only fruits and not the leaves of chillies, brinjal and tomato.

Control: Diseases caused by *Alternaria* are amenable to control by Bordeaux spray. Since it is customary to spray chillies for the control of fruit rot caused by *Colletotrichum capsici* the same treatment will be useful for the control of the disease caused by this fungus.

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A Note on the Different Modes of Price Fixation in the Regulated and Unregulated Markets in Madras and other States

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In a country like India which is and is bound to remain so predominantly agricultural, the importance of a rational system of marketing cannot be over-emphasised. A mere improvement in production does not very often confer a proportionate benefit on the grower or assist to improve his economic position, because the grower who is ordinarily an indebted man is compelled to sell his produce immediately after the harvest, which usually coincides with a slump in the market. The middleman or the village petty merchant and the wholesale dealer in the assembling centre often get a much bigger share of the price paid by the consumer than the actual producer who labours in the field for a full season. Any plan for improving the lot of the village farmer must therefore, tackle the problem of rural marketing and enable the producer to get as big a share of the price paid by the consumer as possible, eliminating the share of the middle men as much as practicable. This in fact is the aim of all the Regulated Markets controlled by Market Committees set up under the Madras Commercial Crop Markets Act 1933. Though the Regulated Markets seek to assist the grower in many ways, such as bringing the producer into direct contact with the purchaser, elimination of unauthorised deductions and allowances, restricting of brokerage and commission charges to reasonable levels, ensuring cash payment on the spot and the like, the most important service rendered is in the system of fixing the prices for the produce brought into the market. If the price fixation is to be done to the best advantage of the grower the following conditions have to be satisfied.

1. The produce for sale must be kept open for examination and quotation of prices by as many purchasers as possible so that a really competitive price is assured to the seller.
2. The seller must have the final voice in fixing the price i. e. to accept or not the maximum price offered by the purchaser on a particular lot while the buyer shall not have the liberty to go back on the rates once offered by him.
3. All payments must be made on the spot or within such short intervals as may be fixed by the market rules, and the Market Committee must undertake the responsibility for enforcing fulfilment of the contracts entered into between the purchaser and seller at the time of fixing the bargain, without encroaching on the civil rights of either party.

4. All weighments or measurements of produce must be done by those licenced by the Market Committee using only scales and weights or measures bearing the stamp of accuracy affixed by the Market Committee.

5. There must be provision and means of settling disputes arising in the course of transaction expeditiously, by impartial arbitrators.

With a view to achieve these objects the following procedures are adopted in the sales yards of Regulated Markets.

i. Auction by shouting of each lot of the produce and selling to the highest bidder if the rate offered is acceptable to the seller as in Guntur Tobacco Market.

ii. Auction by secret chit tender as practiced in the market yards of the South Arcot Market Committee.

iii. Fixing price by auction for the best quality of the produce and then fixing the rates for individual lots by making allowances for difference in quality from the ideal for which the price is fixed by auction, as in the Adoni Market.

iv. Fixing prices by private negotiation under cover or by open words between the buyer and the seller or his commission agents as described against Tirupur, Amraoti or Dhulia Markets.

The comparative merits of each system are discussed below with reference to the actual details of the systems adopted in some of the important market yards in the country.

(i) **Amraoti Yard**: This is one of the oldest of the Regulated Markets in India and the commodity dealt with is cotton. The market yard opens at 5–00 A. M. when carts with kapas and lint from various villages enter the yard by the main gate and the carts are conducted into the stalls of commission agents of the sellers' choice. At 6–00 A. M. the price ranges and important market quotations including American and Liverpool futures are put up on the notice board of the market yard. The regular trading then starts. The buyer goes to each cart, examines the stuff and quotes his rates for the same under the cover of cloth, the sellers' commission agent acting as the intermediary. When the commission agent thinks that a fair bargain is obtained, he informs the cartman accordingly. It is only when the cartman who has previous instruction from the owner (if the owner is not present on the spot) or the owner himself (if present in person) accepts the rate, the price is openly declared. Immediately an agreement is filled up in duplicate in the prescribed form showing details of the buyer, seller, rate fixed etc., and signed by both commission agent and the purchaser. A fee of one anna per cart is charged by the market committee to the buyer as its fee. Weighment is done by licensed weighmen and the payment is made

on the same day. Thus in effect the transaction is one under private negotiation through brokers or commission agents. Details of bargaining are kept secret. The chief defects are:

i. The illiterate cultivator is entirely in the hands of the commission agent who is often inclined to favour the buyer.

ii. The ancient practice of fixing the price under cover of cloth by secret signs is still in vogue. This keeps the seller in the dark as to trends in the market with reference to the published market data even.

iii. After a few weighments the buyer or his broker frequently finds fault with the quality and asks for a price reduction. The cultivator who usually comes from a long way, bearing all the costs of transport is usually left with no alternative at this stage but to agree to such arbitrary demands. Although market rules provide that prices shall be fixed in the market yard, and that no deduction shall be made except when the quality of cotton is inferior to the sample on the basis of which price is fixed, these rules are only loosely enforced and the general practice is to make deductions in weighments by 1 to 4 Dhadis (7 to 28 lb.) from the actual weight of a cart load. Occassionally carts are also allowed to be taken directly to the ginning factories without entering the yard at all.

(ii) **Dhulia Market**: This is the biggest of the Regulated Markets in Bombay State transacting business of over 50 to 60 thousand bales of lint per year. As at Amraoti the prices are offered under cover after seeing the produce. The ruling prices at Bombay and America are received by telegram and put up every day at the entrance of the yard for the information of buyers and sellers. The practice of settling prices under the cover of cloth is unfortunately in vogue here also. The rest of the procedure is more or less as in Amraoti, but there is better check over the weights and weighment and mal-practices in weighment seem to have been checked. No deductions are allowed in weighments.

(iii) **Adoni Market in Madras State**: The auction sale of cotton and groundnut brought for sale is conducted at 10-00 A. M. on all working days. There are 58 commission agents at this centre and they are divided into six groups, each group being composed of an equitable number of the big and small commission agents and of stocks coming to their shops. If any day happens to be a holiday, the arrivals in shops allotted for that day shall be auctioned next day along with the stocks of the group allotted for that day. Thus each commission agent gets his turn of auctioning the produce of his constituents once a week and in his shops on other days also the sellers so desire.

Prior to the commencement of the auction the buyers go round the shops allotted for that day and examine the stocks put up for sale. In the auction the rate declared is understood to be for the best quality of the season's produce. After the auction declaration, the highest bidder is enjoined to purchase all the produce placed for sale by the Commission Agents in the godowns allotted for the day, at the rate declared in the auction. Produce in the other godowns is allowed to be purchased by the other traders by mutual bargaining and negotiation. For each transaction the rate declared in the auction will be ruling rate for the day. If the produce is found to be of inferior quality reductions in rates will, however, be allowed with the consent of the seller. After the bargain is struck by the buyer, no alteration in the rates will be allowed. In case there are no buyers for the day to purchase the goods in the commission mundies other than those allotted for that day, the highest bidder in whose name the auction has been knocked down is further bound over to purchase the entire produce from other shops as well. This latter provision aims against irresponsible or insidious excitement being promoted in the auction. If there are any disputes in respect of the transactions the committee's decision is final.

The chief defects in the system are that the grower is entirely dependent on the commission agent, and deductions in rates are allowed on the plea of poor quality which might more often than otherwise be used against the interest of the seller, in the absence of any standard and recognised specifications as to quality. The buying commitment in respect of the entire produce in the allotted godowns for the day insisted on might have the effect of limiting the bid to the general average of the quality of the produce in those godowns. This rate is then applied to be the one for the best quality of the season's produce. This kind of bulk auctioning without reference to any specific goods militates against any proper appraisal of quality and against adequate recompense being paid for improvements in quality. Instances are not unknown of prices above the declared rate in auction being offered and accepted. Individual buyers who are inclined to offer better prices in this way are ostracised by the entire body of other traders and in effect a dominating clique among the traders is promoted to the disadvantage of the sellers. The system on the whole is a most undesirable one and it does not encourage individual traders to study the market and operate on it intelligently.

(iv) **Tirupur Yard**: No auction sales are usually held at this yard. The prevailing market rates at Bombay New York and Alexandria are obtained daily and published on the notice board of the Committee. The buyers go round the commission agents' mundies inside the market and offer their rates after examining the stocks available for sale. The price offered by the buyer is noted in a chit and if the rates are acceptable to the commission merchant or to the seller if present, the bargain is struck. In the case of lint, price bargaining take splace outside the market yard and as soon as the transactions are finalised, the buyer and the seller come to the yard and sign the contract form in the presence of the Superintendent of the Committee and leave a sample with the Committee. This practice might be considered to be a weakness in the regulation of the markets as under the existing statutory restrictions no buying and selling can take place outside the market yard within a five mile limit of Tirupur. In case of any dispute in passing the deliveries against such sales, the sample with the Committee is made use of for settling the dispute. In the case of kapas, the merchants report to the Committee at the end of the day in the prescribed form showing details of names of sellers and purchasers, rate and quantities sold. No deductions are allowed for poor quality etc., after the rates are once agreed to.

Here also the growers have to depend on the commission agent, since there is no auction sale in the yard. Though the seller has the option to reject the rates arrived by the Commission agent and the buyer, it is seldom exercised, as in most cases the commission agent acts for the seller. Weights are strictly checked by the committee and no deductions whatever are allowed.

(v) **South Arcot Market**: This is the most important and perhaps the best organised market in South India. More than 90% of the groundnut marketed in the district gets sold through one or other of the eight markets set up by the market committee at important and convenient assembling centres. More than 70% of the quantity thus sold in these markets is brought in by the growers themselves and sold direct without the intervention of an intermediary. Thus the ideal of bringing the producer in direct contact with the purchaser to the exclusion of middlemen as far as possible is achieved in this market to a great extent. Groundnut is brought in the form of kernels in bags and the sale is conducted by secret tender system. Every morning, except on holidays, when the yards commence working, the lots belonging to individuals are given lot.

numbers as they arrive. They are then poured out of their bags, shuffled, rebagged and weighed and the weights of each lot is also notified. Slips are then prepared giving lot numbers and these are issued to buyers assembled in the yard between 10-00 A.M. and 11-00 A.M. in two or more rounds of auction fixed at convenient intervals. The buyers go round the lots, examine the quality of each and write in the bid slips against each lot the price they offer for that lot. After quoting prices for all or as many lots as each merchant might be interested in, the slips are deposited in a hundi box kept for the purpose. The box is opened at an appointed hour notified beforehand. After collecting all the slips from the box the Superintendent of the yard reads the prices offered for each lot and the maximum for each lot is announced. If the owner is satisfied, which is usually the case, the sale is confirmed by notifying the price confirmed and the name of the buyer. The weighment chitta made out initially is also completed for each lot with the entry of the name of the buyer and the price determined and one copy each is furnished to the seller and the buyer. In the copy to the seller, the total amount due is also calculated and noted for the benefit of the sellers as a precaution against his being cheated in the calculations. The payment is arranged on the spot by the buyer and he clears the lot. If, however, the rate offered by the highest tenderer is not satisfactory to any seller, he is at liberty to take the produce back or keep it in the Market Committee's godown for reauction on the same day or the next day. Weights and sales in use within the Committee's markets are provided by it and they are tested and kept accurate at frequent intervals. Weighment is also done in the immediate presence of a clerk. This system is perhaps the best and simplest among all the systems followed in the markets of this State. The main difficulty in adopting this system in other yards will be the existence of long-established commission agents functioning between the producer and the purchaser.

(vi) In western countries, open auction by shouting is the method usually followed, as can be seen from the tobacco markets of Kentucky in America.

The sales usually start at 9–00 A. M. and continue throughout the day with a short recess at noon, the buyers moving from warehouse to warehouse. During the height of the season, three sets of buyers operate, in order to keep the tobacco moving and to prevent congestion. At the time set for sale at a particular floor, the various buyers gather round and the auctioneers take their place

near the first basket in the first row. The floor manager of that particular warehouse works one basket ahead of the autioneer and the buying crew, and as the latter come upto the basket he states what he thinks of the minimum value thereof per pound. Starting with this, the auctioneer then calls out the bids and if necessary even goes below the minimum suggested to get the bidding started, and then advances as bids are made in the usual way. The lot is invariably sold to the highest bidder. On the tobacco which is priced $ 6 per cwt, the bid to be raised must be increased by at least 10 cents and for lots priced $ 6·50 to 20, each rise must be by 20 cents and for lots priced from $ 20 to 30 the increase must be only in dollars. These limits are evidently prescribed to facilitate quick sales. The sales are in fact so quick that an average auctioneer disposes of not less than 200 baskets per hour. As each basket is knocked down, the buyers initial the price paid and the commercial grade of the leaf are then entered on the basket as well as in the warehouse office book. The buyers may be representatives of large and small factories, or of foreign Government monopolies, brokers buying for commission or for speculative purposes or mere speculators or 'pin hooks' as they are called by the Trade. The only restriction is that each buyer must be a member of the Lexington Tobacco Board of Trade, for being recognised on the floor. This Board represents tobacco commercial interests and consists of manufacturers or their agents, company buyers, brokers, warehousemen and speculators. The actual farmers are only indirectly represented through their membership in the warehouse companies.

An adaptation of this system of open auction by crying is followed in the market yards of the Guntur Market Committee for the sale of tobacco. Tobacco entered for auction is given an identity card describing the seller, in each lot. Auctioning proceeds bundle by bundle. The bundle is opened for buyers to examine quality and bidding is initiated by an upset price amount fixed by the Committee's auctioneer. The highest bid is marked in the identity card and attested by the auctioneer and the buyer or his representative who also marks the grade as appraised by him. Weighment and settlement at the price declared in the auction follow. The auction in this manner proceeds from 8–00 A. M. to 12–00 noon each day. This system fails to register much advantage to the sellers when there is no buying competition due to lack of sufficient buyers. It also requires the buyer to wait till the

particular lots in which he is interested is brought up for auction. At present only one auctioneer is employed and in days of heavy arrivals he is unable to get through the entire lot within the allotted time of 8-00 A. M. to 12-00 noon.

(vii) Some such system of auction by shouting is followed in some of the unregulated markets in South India also, like the groundnut market attached to the Leigh Bazaar at Salem and the mango market at Vellore. This system has the great advantage of quick and ready disposal, when large numbers of people bring their produce for disposal, side by side with the presence of a good number of buyers. In the other unregulated markets like the tobacco market at Palghat, arecanut markets at Mangalore and the various cattle markets in the State, the system of secret bidding and bargaining under cover of cloth is still in vogue. The parties to these close bids are also usually the buyers and the commission agents acting on behalf of the owners of produce. The system has its own drawbacks from the point of view of the growers' interests, as already explained before.

Considering all aspects, the best system for adoption by the regulated markets in the State seems to be either the open auction by shouting as followed in the West and in Guntur tobacco markets or the secret tender auction followed in the South Arcot Markets. The systems followed in Adoni and Tirupur which promote the dominance of commission agents are not conducive to the interests of the producers.

Summary: The main modes of price fixation followed in the different markets are:—

1. The closed bargain system of fixing the prices under cover of cloth by the sellers' commission agents and the buyers and announcing the rates on obtaining their acceptance by the sellers, followed by regular execution of agreement in the form prescribed by the market committee as is done in Amraoti and Dhulia markets.
2. The system of negotiating the prices by the sellers, commission agents and the buyers and reporting the agreed rates to the market committee for signing the contract as is done at Tirupur.
3. The rather complicated system of auction sale followed in Adoni market of allotting different groups of merchants for taking part in auctions held on each day of the week fixing the price in terms of the best quality of the produce and then allowing deductions in rate for poor quality, and compelling the highest bidder of the day to purchase all stocks put up for sale on that day.
4. The comparatively simple system followed at Cuddalore and other markets in South Arcot of allotting numbers to each lot that is put up for sale and allowing all the buyers to examine each lot and offer their maximum rate for each lot in a slip of paper containing a list of all the lots put up for sale on that day. The maximum rates quoted for different lots are then tabulated by the market superintendent and

announced. If the sellers agree to the highest offers made, the transactions are finalised and the contracts signed in the prescribed form.

5. The open auction by shouting and disposal on the spot as is done in the more advanced markets like the tobacco market at Guntur or the still more advanced tobacco market at Kentucky in U. S. A.

The main disavantage in the first three systems is that the producers are left entirely in the hands of the commission merchants who are often inclined towards the purchasers. In markets like Amraoti and Adoni arbitrary deductions in weight are often made against the alleged poor quality of the produce, even after the transactions are finalised. At Adoni there are other restrictions also operating against the interests of the seller such as restricting of a day's auctions to a particular group of merchants, fixings rates on the basis of an imaginary best quality which invariably results in the bidder claiming deductions against poor quality.

The special advantage of the Cuddalore system is that the producer is brought into direct contact with the purchasers and facilities are allowed for free and open competitive bidding by the buyers. As the bids are made after examination of each lot no deductions are allowed for quality or any other factor after the terms are once finalised. This system as well as the open auction by shouting followed at Guntur are the best among the systems now in vogue in India and they also conform more or less to those in vogue in the more advanced western markets. The main impediment in introducing these systems in all the markets would be the existence of so many commission merchants who act as links between the producers and the purchasers to the disadvantage of the former. It is to be considered how best this difficulty could be got over and a fairly uniform system enforced in all market yards.

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Dormancy and Germination of a few Crop Seeds

by

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Introduction: The importance of "good seed" is well realised in Agriculture. Good seeds are those in which every seed is capable of giving rise to a healthy plant of the kind, when placed under suitable conditions of growth. The quality of good seed is dependent upon a number of factors, such as the maturity of the seeds, purity, the methods of storage adopted, the period of storage after harvest, the age of the seed and the incidence of pests and diseases during storage. For the determination of the quality of the seed and arriving at its real value two important factors namely (i) Purity and (ii) Viability are considered. The data on germination and dormancy both published and unpublished supplied by the various Crop Specialists of the Madras Agricultural Department are summarised in this article.

1. **Paddy**: (a) *(Oryza sativa, L): Dormancy:* Fifty-eight strains of paddy seeds were tested in Paddy Section for germinability commencing from one week after harvest up to several weeks after, until the seeds gave 95 to 100% germination. Short-term paddy strains showed good germination even in the first or second week from harvest, but medium and long duration paddy strains required varying "rest" periods, from three to 13 weeks. Notable exceptions to this general observation were in PTB 7, ADT 6 and ADT 7. PTB 7 is a four-months variety and it failed to give satisfactory germination till after the 9th week, while ADT 6 and ADT 7, the two long duration strains gave good germination even from 6th and 8th weeks after harvest.

(b) *Viability:* This was found to vary with different varieties. GEB 24 maintained a high viability for 13 months, after which there was a steady decline to 30%. Thereafter for another 11 months the same germinating capacity was maintained. CO 1 was good for 15 months, but dropped to 49% in 24 months. CO 2 and CO 3 showed a little more variation and after 12 months dropped to 20% in 24 months (Paddy Specialist, Station Report. 1926-27).

(c) *Storage and Germination:* Drying paddy seed material soon after threshing and then storing is very important in maintaining the viability of seeds. In non-dried lots the germination is spread out and as the seeds become older, they lose their viability very badly. Trials at Maruteru have shown that the seeds stored even in four-fold gunnies lose their viability badly during the monsoon season; but occasional dryings improved the viability in such seeds. It was also found that a high percentage of viability could be maintained by storing the seed in double gunnies, with two or three dryings in the interval.

The effect on paddy germination of napthalene used during storage to prevent insect attack, was investigated at the Agricultural Research Station, Aduthurai and the following observations have been recorded; (i) Varying quantities of naphthalene did not affect germinating capacity of the dry seeds of ADT 2, 3 and 4 for one year, after which indications of deterioration were visible, while in the case of *Jeeraga sanna bhatta* (AOB 178) a scented variety, the fall in viability was much earlier, in about six months by naphthalene treatment. (ii) Paddy varieties stored in gunny bags along with naphthalene are not affected for a period of seven months, after which the germination becomes slow. (iii) Naphthalene left with seeds soaked in water before sowing did not injure the growing embryos but if the seeds, are subjected to the influence of naphthalene vapour after germination had started, the tender radicle and plumule were injured. (iv) The combined action of naphthalene vapour and a saturated moist atmosphere seriously affect the viability of paddy seeds within a much shorter period than by humid atmosphere alone.

In the storage of paddy seed in Malabar and South-Kanara, especially with reference to strain CO 3, it is found to deteriorate during the monsoon season, when stored in gunney bags or *murra* (straw twists). Investigations with different varieties of rice have shown that there is a close correlation between such deterioration and the capacity of the grains to germinate immediately after harvest. A simple method to overcome such deterioration was evolved at the Agricultural Research Station, Pattambi. The seeds were soaked in water for about 5—10 minutes and air dried, taking care to see that they did not dry to excess. The treated and stored seeds gave 80 to 100% germination while the control gave only 12 to 30%. The treatment does not affect the yield of either the grain or straw of the resultant crop.

Paddy seed kept in cold storage at 0–4°C at Coimbatore, maintained their viability even after 15 years of storage.

2. **Millets:** (a) No work appears to have been done so far, on the dormancy of millet seeds.

(b) *Viability:* Well-dried seeds of millets kept in tin screw-top bottles have maintained about 70% germination for a period ranging from two to three years. With the preservation of large quantities of seeds for seed purposes germination tests were carried out in 4 strains of cholam (CO 4, CO 7, CO 8, CO 9) and one strain of cumbu CO 1, after storage in metal containers with frequent dryings. In cholam the initial germinations were ranging from 91 to 96% in the four strains and after 23 months of storage the germination ranged from 69 to 78%. In cumbu the germination at the start was 96·5% and this was maintained for 23 months. In Poona, Sonavne (1928) found that in cumbu germination fell from 94·5% in the first year to 61·2% in the fifth year, and in cholam the same author found the initial germination to be 89·7% and after five years to be only 79·1%.

(c) *Storage and germination:* An experiment for determining the loss in germination and deterioration in storage, was conducted in the Millets Section with *Cholam, Cumbu, Ragi, Tenai, Panivaragu* and *Samai.* Forty pounds of seeds in each were packed in (i) single gunny and (ii) double gunny and subjected to (a) sun drying once a month and (b) no sun drying under each of the two packing treatments.

(i) **Cholam:** *Periodical drying vs. no drying;* The sun-dried seeds show a definitely better germination, than seeds which are not periodically sun-dried. At the end of one year, the sun-dried seeds showed a germination ranging from 61 to 70%, as against 33 to 58% in seeds that were not dried.

Storage in single gunny vs. double gunny: Storing in double gunny did not show any decided advantage over storage in single gunny at the end of one year. After this period, there was a rapid fall in the germination of grains in all the methods of storage, due to heavy infestation by storage pests.

(ii) **Cumbu:** The grains of cumbu keep better in storage than cholam grains. There was no appreciable difference in germination between the different treatments under storage.

(iii) **Ragi, Tenai, Panivaragu** and **Samai:** These grains keep very well in storage and the initial germination percentages were maintained even after 22 months of storage. They do not also seem to need much attention, as they are less liable to insect attack than either cholam or cumbu. There was no difference between double and single gunny packings.

3. **Pulses:** Studies on the dormancy and viability of pulse crops have not so far been undertaken in this State. However, the little information on dormancy available from other States shows that green gram *(Phaseolus radiatus)* and black gram *(P. mungo)* gave low germination when tested immediately after harvest but improved later, with storage (Sonavne 1928). Patwardhan (1927) found that hard seeds which were more in number in the initial stages decreased with storage, thereby showing that the hard seeds both in green gram and black gram lose their hardness within a year of harvesting and storage.

Longevity: Sonavne (1928 & 1934) reports that longevity of pulse seeds range from seven to more than 12 years. The seeds gave germination over 70% even after seven years of storage, after which period there was a deterioration in germination. However, a certain proportion of the seeds continued to be alive even after 12 years, in three species (1 to 3) while the rest lost much of their viability by 10 to 12 years.

Species	Year by which 70% of germination was recorded.
1. Phaseolus radiatus	11 Years.
2. P. mungo	9 ,,
3. P. aconitifolius	11 ,,
4. Cajanus cajan	7 ,,
5. Cicer arietinum (Deshi gram)	9 ,,
6. Cicer arietinum (Kabuli gram)	7 ,,
7. Dolichos biflorus	7 ,,

4. **Groundnut:** (a) *Dormancy:* Extensive studies have been made on the dormancy of groundnut seeds (John C. M. et al 1948). The seeds of the spreading variety are dormant and need about 2 to 2½ months from harvest to give good germination. Seeds of the bunch variety have no such dormancy period.

(b) *Viability:* Groundnut kernels and pods keep their viability upto four years when stored in air-tight containers but deteriorate after 12 months when stored in ordinary gunny bags, or tins. Sonavne (1928) reports 92·6, 74.5, 60·2, 28·5 and 23·8 percentages of germinations in five successive years during storage in glass bottles, with a naphthalene ball inside.

(c) *Storage and germination:* Groundnut kernels from the summer crop (February to July), undergo deterioration in storage more rapidly than the kernels from the winter crop. (July to December). Kernels having more than 5% moisture at the time of storage deteriorate to a more marked extent than kernels having less of moisture. Kernels with a high percentage of splits and broken bits

deteriorate rapidly. Storing of groundnuts in the form of pods reduces deterioration considerably, as compared to storing them as kernels.

5. **Gingelly**: *(Sesamum orientale) (S. indicum)*—*Dormancy:* There is no period of dormancy for the seeds of gingelly. *Viability:* From preliminary experiments conducted in the Oil-seeds section it has been found that gingelly seeds stored in air-tight containers remained viable upto three years. In Poona (Sonavne–l. c.) the seeds kept in bottles continued to give 80·5% germination in the fifth year, while the initial germination in the first year was 85·6%.

6. **Castor**: *(Ricinus communis):* The seeds are non-dormant in castor and they keep their viability for about three years.

7. **Coconut**: *(Cocos nucifera):* No experiments appear to have been carried out on the dormancy and viability of coconut seed. The coconut seed is harvested from the parent trees when it is over 12 months old, when the husk is turning brown and drying up. The seed requires a resting period till the husk gets completely dried up.

As regards the viability of the seed it is dependent on the milk inside the seed nut. Seed nuts which do not have milk inside, very rarely germinate. Viability tests for long periods are not of practical importance in coconuts as the seed nuts will usually be planted within six months after harvest. The method of storing nuts to retain the water inside, for about six months is, therefore, important and experiments have been conducted to find out the most efficient method. Seed nuts when kept exposed in storage soon lose both the water and viability. They can however be stored for about nine months in sand without much loss in viability. Nuts harvested in march could be stored in sand for a period of even nine months, with a germination of 76%. For periods of six months and less the germination is normal, going upto 95% when the seed is preserved in sand.

8. **Cotton**: *Gossypium,* spp.: (a) *Dormancy:* Information on the dormancy of cotton seeds is not available.

Viability: Cotton seeds can remain viable even upto 19 months from the date of harvest. In cotton, the seeds required for sowing need not ordinarily be preserved for a period exceeding five months from the date of harvest, although seed stocks left over in Government Seed Farms after the season's sowings, present a serious problem. The experiments conducted by the Cotton Specialist,

Coimbatore, indicate that seeds harvested in one season, retain their viability for two successive seasons. If the germination capacity of the surplus stock at the end of the first sowing season is satisfactory, say upto 70%, periodical drying will help to maintain the seeds in a satisfactory condition for sowing in the next season. Sonavne (1928) reports only 58·6% of germination in cotton in the first year which rose to 67·3% in the second year and thereafter fell to 58·0, 55·8 and 53 3 percentage, in the third, fourth and fifth years respectively.

(c) *Storage and germination:* Experiments to ascertain the germination of cotton seeds in the lower bags when arranged in tiers indicated that the top layers recorded significantly better values in both total percentage and rate of germination. It is desirable to recommend storage of cotton seed in depots in tiers of not more than six bags.

10. **Green Manure Crops:** A few green-manure crops gave the following data in the initial germination tests and after 45 months of storage in the Botany Section, Coimbatore.

Green manure crop	Initial germination	After 45 months of storage
Sunhemp	63—77·5%	53—59%
Pillipesera	71—83%	41—47%
Daincha	82—88 5%	43·5—51·6%
Kolinji	46—52%	43—55%
Indigo	36—45%	30—42%

In Kolinji the germination increased after a few months of storage and high germinations of 71 to 82% were obtained between the 15th to 18th months of storing.

Indigo showed poor germination from the beginning. Under storage treatments of sundrying it was found that there was a decrease in germination percentage with sun-drying, while under non-sundrying the germination percentages were maintained without deterioration even after two years of storage.

11. **Fodder and Pasture Grasses:** (a) *Dormancy:* No information is available on the dormancy of grass seeds, and trials have just been initiated in the Botany section.

(b) *Viability:* The seeds of a few South Indian fodder grasses were tested for their viability (Chandrasekharan et al 1950), the seeds being stored in thick brown paper bags and tested in germination trays in the laboratory.

Only a few grasses like *Panicum antidotale* and *Enteropogon monostachyos* gave good germination, reaching 80%. The popular *Cenchrus ciliaris* and *Iseilema laxum* have only 35 to 48% germination capacity and the other grasses are even less, giving only 25% germination.

(c) *Storage and Germination:* Generally with storage, there is decrease in germination capacity every year. Many of the grasses retain their viability in the second year of storage but deterioration is evident from the third year. Except in a few, many of the grasses have lost their viability in the fourth year of storage completely. But in temperate regions pasture grass seeds retain their viability upto light or even 13 years. (Carruthers. 1911). Only in *Panicum antidotale* (Australian drought-resistant grass) the germination percentage continued to be high (65 to 87%) upto six years in storage at Coimbatore.

Discussion: It is believed that crop seeds do not germinate well when kept for more than one year after harvest. The data available on some South Indian crops presented above, show that in most cases the seeds remain viable for over two years when tested under laboratory conditions. More information remains to be gathered regarding the germination of crop seeds when stored under ryots conditions.

It is also generally believed that in humid climates, crop seeds lose their viability within a year (Robertson & Lute 1933). The viability of seeds under arid conditions have to be studied in more detail before any conclusion can be drawn. Percival (1935) recommends two years as the time within which it is advisable to sow wheat and maize seeds in temperate regions. Observations on these two crops by Sonavne (1928) in tropical conditions at Poona show that viability remained good for about five years. It is therefore, necessary to work out the viability of the crop seeds in detail for tropical conditions, to determine the time upto which they can be stored, for sowing purposes.

The percentage of germination which should be considered as good, fair and poor for each crop seed is another point which needs definition. From the data available so far the following is considered as a tentative definition of germination percentages.

Crops	Percentages of germination, on which it is considered to be		
	Good	Fair	Poor
	Above	Between	Below
Paddy	95	90—95	90
Cholam	90	80—90	80
Cumbu, Ragi, Tenai, Samai, Panivaragu, Kudiraivali	90	80—90	80
Varagu	85	70—85	70
Pulses	90	80—90	80
Groundnut	90	80—90	80
Gingelly	85	70—85	70
Cotton	80	80—80	60
Sunhemp, Pillipesara	90	80—90	80
Daincha	80	70—80	70
Kolinji	80	60—80	60
Indigo	65	55—65	85

In most of the crop seeds in the tropics, dormancy has not been studied in detail. Harrington (1916) found that dormancy exists among many species of cultivated plants. Spaeth (1934) states that "the seeds of cultivated plants have been found to be less dormant than those of the wild species from which they have been derived. Most of the causes of dormancy are hereditary; however, such characters as the impermeability of seed coat as one of the causes for dormancy, may be modified by the climate in which the seed is produced." Seeds having dormancy do not germinate before their dormancy period is over. The methods by which germination can be hastened in dormant seeds also require investigation.

Acknowledgments: The authors are thankful to the various Crop Specialists for the information furnished by them, which has been freely used in this paper.

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REVIEWS

Flore du Congo Belge et du Ruanda-Urundi — Spermatophytes. Vol. IV. *Publications of the Institute National L'Etude Agronomique du Congo Belge. Brussels 1953. p.p. 1-314 (with a map and illustrations in the text):* This part deals entirely with the *Papilionaceae*(part 1) (1. *Sophoreae* by L. Toussaint; 2. *Genisteae* by R. Wilczek; 3. *Trifolieae* by J. B. Gillet and 4. *Loteae* by R. Boutique). The tribes have been divided according to the nature of the stamens viz., I. A. free or adnate at base; B. Variously united. II. Stamens diadelphous (9) + (1) or (5) + (5). Further classification is on the petals and then the pods, dehiscent or indehiscent. *Sophoreae* has been divided firstly on the leaf character – A: unifoliate and B: plurifoliate. Next are taken into consideration the clayx campanulate or non-campanulate nature of inflorescence, presence or absence of bracteoles. Eight genera are dealt with. In the tribe *Genisteae* five genera have been described. Of these the largest number of species are in *Crotalaria* (189 species). In *Trifolium* the classification is done primarily on the stipule character and secondarily on the inflorescence. Only two genera are dealt with. In *Loteae* only the genus *Lotus* is described. Belgian Congo is said to have about 80 genera and 800 species. The distribution of these genera and species is of great interest to India in that similar genera occur here also and therefore there is great scope for introduction of the species especially of economic tribes like *Genisteae (Crotalaria), Phaseoleae, Vicieae* etc. (N. K. S.)

Journal of the Annamalai University. Vol. XVIII; 1953. (Published by the Annamalai University, Annamalainagar: Pp. 228.) This volume has many interesting topics from philosophy to science and literature written by eminent workers in the field.

Studies on the mercuration of aromatic compounds by V. Thiruvenkatachari :— This is a part of the thesis submitted by the author for his M. Sc. degree, and deals with the various reactions like halogenation, nitration, bromination and mercuration and the author has in particular tried to fit in his observations in mercuration to prior references of work.

Suryanarayana, C. V. An alternative to Bancroft's over-voltage theory in the interaction of metals with nitric acid :— The reaction between the metal and nitric acid is discussed by the author in terms of the Bancroft's theory which is based on the older view of Armstrong and Acworth, according to which the reaction was visualised as an electrolytic action occurring in two phases, at the cathode and at the anode and that when the distance between the electrodes vanishes a chemical reaction occurs. This theory is criticised by the author based on Dhar's criticism of the same and presents a new conception of the reaction as crystal energy of a metal as also of all the inorganic and organic reducing agents in their interaction with HNO_3. (A. M. K.)

Dr. S. Krishnamurthy has given a handy tabular statement of the chief distingushing characteristics of the species of *Citrus* based primarily on Swingle's classification. As the author has put it, no final word as yet has been said about *Citrus* taxonomy. He has also explained in what way his classification differs from that of Swingle and has added a list of correlations. This will be very useful for all students of *Citrus*. The Agricultural Department of the University though young has recorded some of its work in the trial and propaganda for the improved strains of paddy. As a seed-farm it has been able to give the Department of Agriculture, Madras with pure seed enough for two thousand acres. Both short and long duration strains are being tried. A short note also appears regarding the use of zinc phosphide as a rat poison and the results obtained in its trial at the University-Extension Farm. (N. K. S.)

Perhaps the most interesting article in this number is the one by Sri C. R. Myleru on "Some Dravidian loan-words in English". The writer traces the derivation of a number of Dravidian words that have passed into current English usage, such as curry, peon, paddy, betel, mango, cash, cooly, coir, etc. Although some of these derivations might not be accepted by all, as also the claim that they are all from Tamil, they are more lor less highly suggestive and should serve to stimulate a deeper study of this question. Another very pertinent observation is on the British knack of absorbing into the English language expressive terms and words from a number of foreign tongues. As the writer points out, this shows a very progressive outlook and an abundant vitality and adaptability and is one of the main factors in English being practically a world language at present. This knack of taking in new words from other languages and making them their own is far better than wasting time and effort in translating them into indifferent and unintelligible 'synonyms' as some of our Indian languges are doing now, in the case of foreign words. (T. R. N.)

Other absorbing articles like Ramanuja, a Panentheist, by John C. Plott, Recent Trends in Federal finance by R. N. Podwal etc., also occur.

EXTRACTS AND GLEANINGS

Chemical Destruction of Potato Tops: The destruction of potato tops is frequently desirable, either to prevent the spread of diseases such as Irish blight from infected haulms to maturing tubers, or to hasten the maturing of a potato crop. Sulphuric acid in 15 percent solution, and dinitro herbicides are commonly used for this purpose in the United Kingdom and in parts of North America where blight attacks are prevalent, while mechanical methods of killing the above-ground part of the patato plant are also used overseas. In Australia these practices have been used but little commercially.

Sulphuric acid gives a very satisfactory kill of potato tops under a range of conditions but the high price of this chemical and the difficulties and danger associated with its very corrosive character make its use in Australia undesirable. Sprays of sodium dinitro–ortho–cresylate (sodium DNOC) alone and mixed with diesel oil or sulphate of ammonia, gives a reasonably good kill of potato tops in some instances. In view of this uncertainty and the fact that on at least one occasion the tubers from plants killed with this chemical showed internal discolouration, blistering of the skin, and a taint resembling the smell of carbolic acid-type disinfectants, its use as a herbicide for potatoes cannot be recommended. Other chemical herbicides which were used with indifferent success are sodium arsenite and sodium chlorate and sodium ethyl xanthate.

One chomical proved outstanding in trials over the past three years at Hawkesbury. Pentachlorphenol, commonly used as a wood preservative. dissolved in creosote as a 5 percent emulsifiable concentrate, was used at rates of 2 lb. to 4 lb. per acre, emulsified in 80 gallons of water with 0·1 percent wetting agent and sprayed on the potato tops up to three weeks before the tubers would normally be sufficiently mature to dig as new grade. The 2 lb. rate gave a "good to fair" kill, while rates of 3 lb. and 4 lb. per acre gave a fair kill in three days and an almost complete kill in seven days. With the two higher rates of application maturity was hastened by from ten to fourteen days and tubers were neither discoloured nor tainted. Pentachlorphenol is also toxic to the usual weeds found in potato crops, but to secure a complete kill of such weeds the gallonage of spray should be increased and spray coverage extended to cover both weeds and crop rows.

Hastening Maturity: There are two drawbacks associated with the use of chemical herbicides to hasten the maturity of potatoes. In trials at the Hawkesbury Agricultural College yields have been decreased by as much as 30 percent by killing the tops three weeks before the normal harvest time for new potatoes ; there is also a danger of internal discolouration of the potato tubers. Under dry weather conditions, where a slow kill is desirable, the soil surface should be firm enough to allow the passage of mechinery and machanical methods of potato top destruction would be practicable. A machine known as a rotobeater, resembling a rotary hoe, has been used overseas for this purpose, but trials at Hawkesbury were restricted to scything off the top of the plants. On Saranac potatoes under summer conditicns in January last, this practice proved as successful as the best spray treatments in hastening maturity.

Conclusions: It may be concluded that pentachlorphenol in 5 percent solution in creosote, applied as a low or high volume spray, at rates of 2 lb. to 4 lb. per acre (active ingredient), alone are emulsified in water, has been proved a satisfactory herbicide for potatoes grown under other than very dry conditions, and that scything of potato tops under reasonably dry conditions will hasten tuber maturity. Also, when potato tops are killed before the skins are sufficiently firm for digging as new grade, yields will be reduced. (Agricultural Newsletter, Australia No. ACN/440).

All About the Earth: 1. *Earth's Age is 4·6 billion years* is the conclusion of C. C. Patterson of Cal. Tech. from the analysis of lead isotopes in meteors and Oceanic minerals. (Chem and Eng. News Nov. 1953.)

2. *Earth was never molten.* According to Harold C. Urey of the Institute of Nuclear studies of the Chicago University. His theory is that the earth did not pass through initial Molten phase but was formed through cementing of practicles of dust present in the clouds of hydrogen and helium swirling about the sun with water, ammonia and hydrocarbon at low temperatures. These formed much like meteorites and asteroids. Large objects thus cemented together then accumulated to form the earth. (Chem and Eng. News Dec. 1953.) A. M. K.

Control of weeds: (i) *Cyperus rotundus:* Deep ploughing (av. depth 13-14") showed diminution in the weeds next season sown with cotton.

(ii) *Water weeds: Najas pectinata, Potamogeton nodosus, P. crispus, P. perfoliatus, P. pectinatus, Ottelia alismoides, Vallisneria aethiopica, Chara globularis* found growing in canals major, minor and smaller distributory ones. Fernoxone mixed with river silt was tried. This should not be applied if any cotton crop is on the field. In a few cases a mixture of the above with 10% slaked lime was also used. When irrigations were stopped and water level in the canal became stable applications of the mixture was done by hand by a team of four labourers and one supervisor, the labourer wading in the water, each with an empty petrol tin filled with the mixture. The tin floats in the water and moves along with the worker. A uniform distribution was thus obtained. The weed began to wilt with in a week of application and progressively increased with time but it was found that the rhizomes and seeds were in no way affected. No difference was observed between limed and unlimed treatments, A number of points were noted. Fernoxone, though non-poisonous to animal life, in higher doses imparts a phenolic flavour to the water making it unpalatable. So an alternative source of drinking water has to be found for villages which depend on canal water. This appears to be selectively absorbed by fish which develop an unpleasent flavour.

Treatment of seed with fertilizer solutions: Fifty grams of seed were wetted with water and immediately dried on a cloth. After weighing to estimate adherent moisture the lot of seed was placed in appropriate solution for one hour. At the end of this time the seed was removed, dried on a cloth and reweighed. Soaking was then resumed for another hour and seeds again weighed. This process was repeated upto five hours in water and various solutions. Solutions used were K_2HPO_4 and KH_2PO_4; strength 0·5, 1·0, 2·0 and 4·0 M. (The uptake of water as determinedd by weight of soaked seed was found to decrease with increase in concentration e. g. after 5 hr. in K_2HPO_4 0·5 M—68·3; 4·0 M—11·3; KH_2PO_4 0·5 M—62·0; 2·0 M—35·0; water 70). Too long soaking impairs germinability also.

Thirty-days old seedlings from pot experiments showed no significant increase in weight in cotton but sorghum showed some difference especially in Soln. A....1 M. KH_2PO_4 and 1 M. KNO_3; Soln. B....1 M. KH_2PO_4 and 0·5 M. KNO_3. It was noticed that the total plant weight was below 5% level of significance but when portions below ground alone were considered the significance was above 5% level. It is felt that this effect may be better utilized in rainfed sorghum sowings (Ann. Rept. Res. Division. Ministry of Agric. Sudan. Govt. 1950-51; Sec. A Economic Botany. M. Corquodale & Co., Ltd. (Sudan) 1953). (N. K. S.)

Weather Review — For the month of March, 1954.

RAINFALL DATA (IN INCHES)

Division	Station	Total for the month	Departure from normal	Total since 1st January	Division	Station	Total for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	0·1	— 0 2	2·8	South	Madurai	1·3	+ 0·6	4·8
						Pamban	0·7	— Tr	3·4
						Koilpatti*	3·3	+ 2·0	7·7
	Tirurkuppam*	0·0	— 1·0	3·1		Palayamcottai	4·9	+ 3·9	8·2
	Vellore	0·2	— 0·1	2·5					
	Gudiyatham*	1·3	+ 1·0	3 4		Ambasamudram*	8 4	+ 6·0	17·2
East Coast	Palur*	3·5	+ 2·5	6·8	West Coast	Trivandrum	5·6	+ 4·1	9·3
	Tindivanam*	4·6	+ 3·9	7·5		Fort Cochin	3·6	+ 1·6	5·1
	Cuddalore	7·0	+ 6·3	13·1		Kozhikode	1·0	+ 0·6	1·2
						Pattambi*	2·6	+ 2·2	2·6
	Nagapattinam	0·9	+ 0·1	4·9		Taliparamba*	1·0	..	1·5
	Aduturai*	2 6	+ 2·1	5·3		Wynaad*	1·1	— 0.2	1·2
	Pattukottai*	1·9	— Tr	6·2		Nileshwar*	1·2	+ 0·9	1·5
						Pilicode*	1·4	+ 1·0	1·6
Central	Salem	0·3	— 0·2	1·3		Mangalore	0 2	— 0·3	0 5
						Kankanady*	0·6	+ Tr	1·1
	Coimbatore (A. M. O.)*	0·9	+ 0·6	4·3					
	Coimbatore	3·4	+ 2·9	6 9	Hills	Kodaikanal	5·1	+ 3·3	11·9
						Coonoor*	9 6	+ 6·5	19·7
	Tiruchirappalli	1·1	+ 0·7	2·9		Ootacamund*	1·8	+ 0 8	4·2
						Nanjanad*	1·7	+ 0 8	3·8

Note :—1. * Meteorological Stations of the Madras Agric. Dept. 2. Tr 1 to 4 cents.

A low pressure wave moved westwards across the Comorin—Maldives area on 1 – 3 – 1954. Another low pressure wave traversed the same path on the 4th and 5th March 1954. On 7 – 3 – 1954 a low pressure wave was moving westwards across the extreme South-east Bay of Bengal. This slowly moved towards west and developed into a shallow 'low' over the extreme South-west Bay of Bengal on 11 – 3 – 1954. This intensified further and lay 150 miles South-east of Nagapattinam on 12 – 3 – 1954. On the next day it weakened while crossing the Palk Strait and lay as a trough of low pressure off Malabar—Kanara Coast on 14 – 3 – 1954, but became less marked on the following day. Under its influence fairly widespread rains occurred in the Madras State from the 12th to 15th of March.

A low pressure wave again moved westwards across Ceylon—Comorin area on 17 – 3 – 1954. On 19 – 3 – 1954 a feeble trough was forming in the east Arabian Sea of the Konkan Coast. This persisted for three days and became less marked. In the meanwhile a low pressure wave moved westwards across the Southern Bay of Bengal and persisted over Ceylon—Comorin area for three days from 22 – 3 – 1954 and passed away westwards. A series of six Western disturbances passed over North-west and North India during this month. Day temperatures were below normal in Tamilnad especially after 12 – 3 – 1954. The noteworthy rainfalls and the Zonal rainfall for the month are furnished below :

Date	Name of Place	Rainfall	Name of Zone	Av. rainfall for March	Dep. from normal	Remarks
13/3/54	Cuddalore	4·4″	North	0·40	— 0·08	Just below normal
14/3/54	Palayamkottai	3·3″	East Coast	3·42	+ 2·49	Far above normal
,,	Ambasamudram	2·18″	Central	1·43	+ 1·00	Above normal
17/3/54	Coonoor	4·85″	South	3 72	+ 2·50	Far above normal
24/3/54	Trivandrum	3 1″	West Coast	1·83	+ 0·99	Above normal
25/3/54	Coimbatore	3·0″	Hills	4·55	+ 2·85	Far above normal

Agricultural Meteorology Section
Lawley Road P. O.,
Coimbatore, 12—4—1954

C. B. M. & M. V. J.

Departmental Noiificatiots

Gazetted Service—Pestings and Transfers

Abraham, Dr. P., Cardamom Specialist, Asst. Cotton Extension Officer, Madurai; Srinivasan, V., Asst. in Pulses, Coimbatore, Asst. Paddy Specialist, Pattambi; Balasubramaniam, T. N., D. A. O. on leave, D. A. O. Madurai; Ramabadhran, G., Asst. in Millets, Coimbatore, S. D. O. Millets, Coimbatore; Samuel Sundara Raj, Systematic Botanist, Aduthurai, Asst. Fruit Specialist, (Horticulture) Coimbatore; Srinivasa Rao, D. A. O. Under Training, Asst. Marketing Officer, Coimbatore.

Upper Subordinates

Balasubramaniam, M., A. D. Ootacamund, Millet Asst. Coimbatore; Balasubramaniam, S., Spl. A. D. Mannargudi, A. D. Pattukottai; Chinnamani, S., Pulses Asst., Coimbatore; Dorairaj, K., Paddy Asst., on leave, Paddy Asst., Tirurkuppam; Fernandez, A., Paddy Asst, A. D. T., A. A. D., A. D. T.; Gnanavaram, I., P. P. A. (Ent.) Pattukottai, A. D. Periakulam; Jalcol Ahmad, N, Asst. in Myco., Oottacamund, Asst. in Myco., Coimbatore; Karunakaran, K., Asst. in O. S. Nileshwar, A. A. D. Shoranur; Kannian, K., Cotton Asst., on leave, Cotton Asst., Coimbatore; Manimandry, A. D. Trichengode, A. D. Trichendur; Nanjappa Maniagar, A. A. D. Arasampatty, A. D. Dharmapuri; Nagaraja Rao, P. R., Ento. Asst., on leave, P. P. A. Myco., Ootacamund; Oblichetty, T. V., Millet Asst., Tirappathur, A. D. Cheyyur; Pranatharthiharan, S. N., F. M. Hosur Cattle Farm, A. D. Hosur; Palaniandy, V. G., Paddy Asst., Tirurkuppam, Paddy Asst., A. D. T.; Purushothaman, P. S, Spl. A. D. Chidambaram, A. A. D. Sathiathope; Raghavan, N, P. P. A. Ento. Ooty, P. P. A. Myco. Ooty; Ramiah, S. M., A. D. Nanguneri, Community Project Scheme, Shermadevi; Rangaswami, N., A. D. Hosur, F. M. Cattle Farm Hosur; Ramadas, R., A. A. D. Sathiathope, Spl. A. D. Com. Project, Chidambaram; Ranganathan, S. R., A. D. Srivaikuntam, Asst. in Mycol., Coimbatore; Subramaniam, V., A. A. D. Gangaikondan, A. D. Nanguneri; Subramaniam, T. V., Asst. in Myco., Coimbatoae, Asst. in Moc., Ooty; Subramania Chetty, N., Cotton Asst., Coimbatore, Spl. A. D. Cotton, Sathur; Shanmugavinayagam, C., A. D. Udumalpet, A. D. Srivaikuntam; Thulasidas, G., Botany Asst., Singampatty, Botany Asst., Burliar Station; Thirunavakarasu, R., A. D. on leave, A. A. D. Arasampatty; Venugopal, K., Spl. A. D. Kumbakonam, P. P. A. Ento., Pattukottai; Venkateswaran, A. N., Asst. in O. S. Marudur, Coconut Nursery, Asst., Pattukottai; Vaidyanathan, V., Spl. A. D. Mayavaram, A. D. Mannargudi; William, P., P. P. A. Ento., Ooty, P. P. A. Myco.. Ooty.